VIDEO DISPLAY BOARD

ASSEMBLY INSTRUCTIONS

TO BE USED WITH NETRONICS ASCII KEYBOARD OR EQUIVALENT

REVISION A

Video Display Board

PARTS LIST (Continued)

Description	Quantity
IC Sockets 14 Pin, 24 Pin, 40 Pin	1 ea.
5 Volt Regulator LM340T or (7805)	1
Heatsink	1
Screw 6-32 x 3/8"	7
Nut 6-32	7
Crystal 9.12384 MHz	1
IC 3870 (F8 microprocessor)	1
IC 34073 (character generator)	1
IC 74LS174	2
IC 74LS163	4
IC 74LS00	2
IC 74LS04	1
IC 74LS02	1
IC 74LS08	1
IC 2102	7
IC 74LS74	1
IC 74LS96	1
IC 74LS266	3
IC 74LS10	2
IC 74LS83	1
IC 74LS367	2
IC 74LS92	1
Transistor 2N4384	3
Transistor 2N4355	1
Resistor 100 ohm (brown, black, brown)	2
Resistor 390 ohm (orange, white, brown)	1
Resistor 680 ohm (blue, gray, brown)	2
Resistor 1K (brown, black, red)	12
Resistor 2.2K (red, red, red)	1
Resistor 3.3K (orange, orange, red)	8
Resistor 3.9K (orange, white, red)	2
Resistor 10K (brown, black, orange)	2
Resistor 22K (red, red, orange)	1
Resistor 4.7K (yellow, violet, red)	1
Capacitor 10uf electrolytic	3
Capacitor 330uf electrolytic	1
Capacitor 33pf disc	1
Capacitor .01 disc	24
Assembly Manual	1

The LS may be omitted and the 74 prefix may be 54, the military version.

ASSEMBLY INSTRUCTIONS

( ) 1. Install the (3) IC sockets at locations U1, U24 and J2. (Solder)

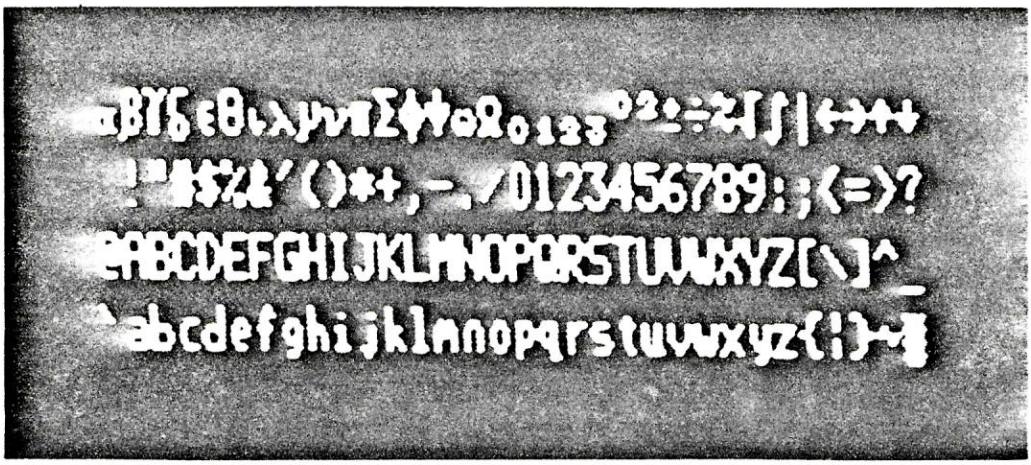
( ) 2. Install the 5 volt regulator LM340T or (7805) at Q-1. (Solder) Place the heatsink between the regulator and the P.C. board and secure with a 6-32 x 3/8" screw and nut.

( ) 3. Wrap masking tape or other insulating tape around the crystal body and install as shown. (Solder)

SPECIFICATIONS

Your Video Display Board (VID) was designed to be connected to a parallel ASCII (Netronics ASCII keyboard) or Baudot signal source. The VID converts the parallel data to serial data which is then formated to either RS232-C or 20MA current loop output which can be connected to the serial I/O on your computor or other interface, i.e. Modem. When connected to a computor, the computor must echo the character received. This data is received by the VID which processes the information, converting the data to video suitable to be displayed on a TV set (using an RF modulator) or on a video monitor. The VID generates the cursor, horizontal and vertical sync pulses and performs the housekeeping relative to which character and where it is to be displayed on the screen.

.Video Output 1.5 P/P into 75 ohm (EIA RS-170)
.Baud Rates 110 and 300 ASCII
45.45 and 74.2 Baudot
.Outputs RS232-C or 20MA current loop
.ASCII Character Sets (128 printable characters)



.Baudot Character Set

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
- ? : * 3 $ & # ( ) . , 9 0 1 4 ! 5 7 ; 2 / 6

.Cursor Moves: HOME, BACKSPACE, H TAB, LINE FEED, V TAB, CARRIAGE RETURN
.Absolute and relative cursor addressing
.Cursor control functions: ERASE, END OF LINE, ERASE END OF SCREEN, FORM FEED, AND DELETE
.50 or 60Hz monitor operation (jumper selectable)

Please check the parts received against the following Parts List:

Description	Quantity
Printed Circuit Board VID-1	1
IC Socket 40 pin	1
IC Socket 24 pin	1
IC Socket 14 pin	1

( ) 4. Install the 10uf capacitors at locations C-1, C-2 and C-30. Note polarity. (Solder)

( ) 5. Apply 8V DC (unregulated) between +8V input and ground. Measure the voltage across C-2, it should be 5V $\pm$5%. Remove the power source. DO NOT proceed if the voltage exceeds 5V.

( ) 6. Install 100 ohm resistors (brown, black, brown) at locations R-13, R-16. (Solder)

( ) 7. Install 390 ohm resistor (orange, white, brown) at location R-11. (Solder)

( ) 8. Install 680 ohm resistors (blue, gray, brown) at locations R-27, R-31. (Solder)

( ) 9. Install 1K resistors (brown, black, red) at locations R-2, R-3, R-6-10, R-12, R-14, R-20, R-26, and R-28. (Solder) Omit R12 when using 20MA loop I/O option.

( ) 10. Install 2.2K resistor (red, red, red) at location R-17. (Solder)

( ) 11. Install 3.3K resistors (orange, orange, red) at locations R-19, R-21-25, R-29, R-30. (Solder)

( ) 12. Install 3.9K resistors (orange, white, red) at locations R-1, and R-4. (Solder)

( ) 13. Install 10K resistors (brown, black, orange) at locations R-5, R-32. (Solder)

( ) 14. Install 22K resistor (red, red, orange) at location R-15. (Solder)

( ) 15. Install 4.7K resistor (yellow, violet, red) at location R-18. (Solder)

( ) 16. Install 330uf electrolytic capacitor at location C-5. Note polarity. (Solder)

( ) 17. Install 330pf disc capacitor at location C-29. (Solder)

( ) 18. Install 33pf disc capacitor at location C-28. (Solder)

( ) 19. Install .01 disc capacitors at locations C-3, C-4, C-6-26, C-27. (Solder) Save excess lead lengths for jumpers.

( ) 20. Install transistors 2N4384 at locations Q-2, Q-4, Q-5. (Solder) Note direction of tab.

( ) 21. Install transistor 2N4355 at location Q-3. (Solder) Note direction of tab.

NOTE: When installing the IC's note the direction of pin #1.

( ) 22. Install IC 74LS174 at locations U-4, U-5. (Solder)

( ) 23. Install IC 74LS163 at locations U-10, U-20, U-21, U-28. (Solder)

( ) 24. Install IC 74LS00 at locations U-6, U-11. (Solder)

( ) 25. Install IC 74LS04 at location U-31. (Solder)

( ) 26. Install IC 74LS02 at location U-8. (Solder)

( ) 27. Install IC 2102 at locations U-12-18. (Solder)

( ) 28. Install IC 74LS74 at location U-22. (Solder)

( ) 29. Install IC 74LS96 at location U-23. (Solder)

( ) 30. Install IC 74LS266 at locations U-25, U-26, U-27. (Solder)

( ) 31. Install IC 74LS10 at locations U-9, U-29. (Solder)

( ) 32. Install IC 74LS83 at location U-7. (Solder)

( ) 33. Install IC 74LS367 at locations U-2, U-3. (Solder)

( ) 34. Install IC 74LS92 at location U-30. (Solder)

( ) 35. Install IC 3870 into the 40 pin socket U-1. Note direction of pin #1.

( ) 36. Install IC 34073 into the 24 pin socket U-24. Note direction of pin #1.

( ) 36a. Install IC 74LS08 at location U-19. (Solder)

The next step is to install the jumpers corresponding to the modes of operation desired. Use the excess lead lengths from the .01 capacitors.

( ) 37. ASCII/BAUDOT, and Baud rate selection

ASCII, 300 Baud : no jumpers
ASCII, 110 Baud : jumper at S-7
Baudot, 74.2 Baud : jumper at S-6
Baudot, 45.45 Baud : jumper at S-6 and S-7

( ) 38. 50/60 Hz operation

50 Hz jumper S-5 : A to C
60 Hz jumper S-5 : B to C

( ) 39. 32 or 64 character per line option (use 32 characters for TV with RF modulator)

32 character per line S-4 : F to N, E to M, D to L, C to K, B to J, A to H
S-1 : A to C
S-2 : A to C
S-3 : A to C

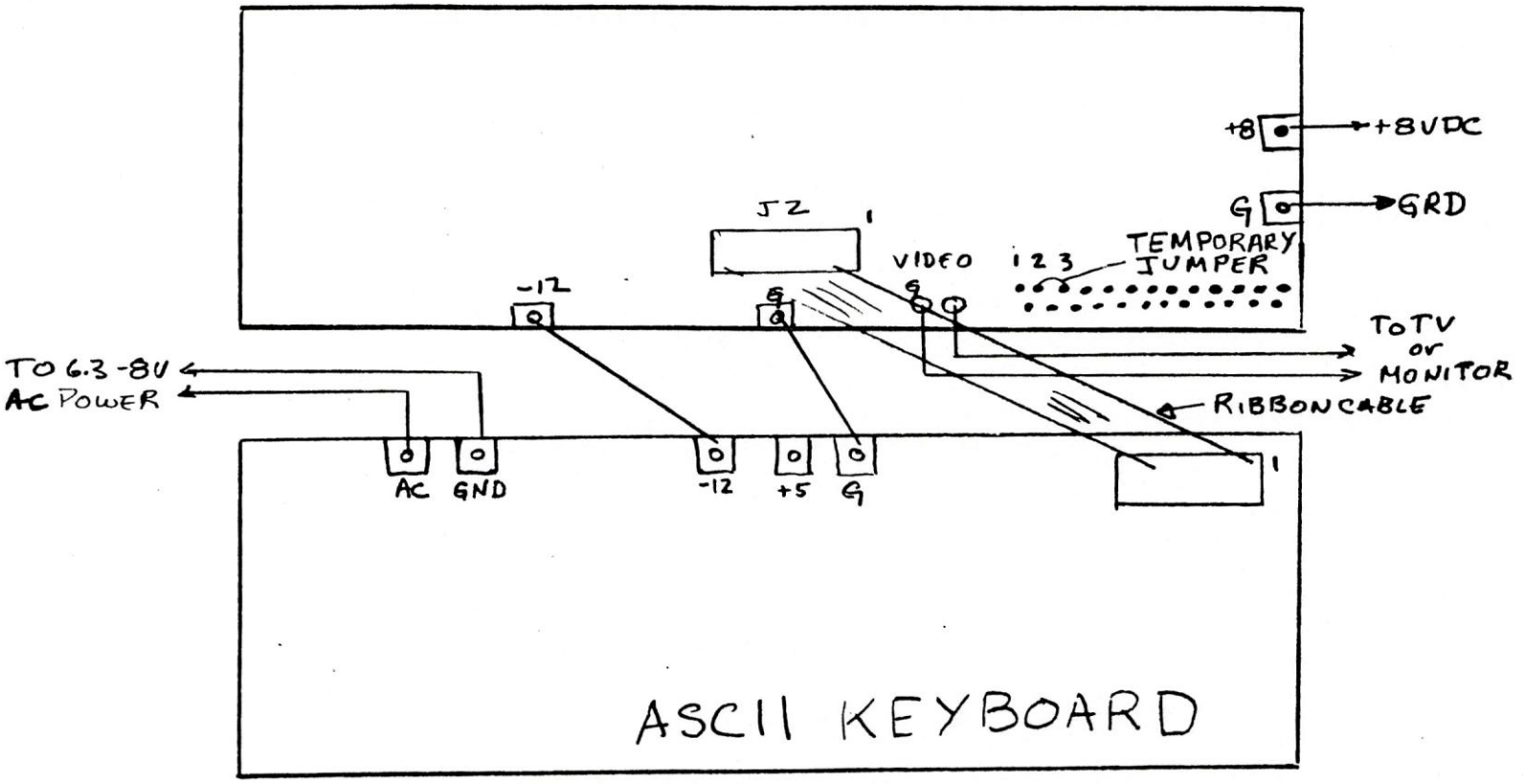
64 character per line S-4 : F to M, E to L, D to K, C to J, B to H, A to G
S-1 : B to C
S-2 : B to C
S-3 : B to C

( ) 40. RS232-C I/O option. (Recommended for ELF and Explorer applications)

S-8 : Out
S-9 : In
S-10 : Out
S-11 : B to C
S-12 : In

20MA Loop I/O
S-8 : In
S-9 : Out
S-10 : In
S-11 : A to C
S-12 : Out
R-12 : Out

( ) 41. Assuming that you have connected the I/O for RS232-C (step 40), we can test the VID and ASCII board independently of a computer. Connect the power supply to your ASCII keyboard and VID as shown below. Don't turn the power on just yet. Now connect the 14 pin ribbon cable from the ASCII keyboard to J2 on the VID. Note position of pin #1. Place a wire jumper between pins #2 and #3 of J1 on the VID board. This allows output of the VID to be coupled directly back to the input. Connect the video output on the VID to your video monitor or TV antenna terminals (thru an RF modulator). Turn on the power and we're ready for our test procedure.



TEST PROCEDURE

(1) Turn on power. Screen should clear, leaving cursor in upper left hand corner.

(2) Type and confirm printable characters on your keyboard. Note: At the end of each line a CR followed by CTRL J is necessary to prevent rewriting over previously typed characters.

(3) Type and confirm special printable characters:

control P	nothing happens
control @	prints α
control P	nothing happens
control A	prints β
control P	nothing happens
control B	prints γ

See Control Codes and Special Symbols Table for special characters and keys to be depressed to display them. Note that a control P must preceed each special character.

Control Codes And Special Symbols

HEX CODE	CONTROL/ KEY	SYMBOL	CONTROL	
00	@	α		
01	A	β		
02	B	γ		
03	C	δ		
04	D	ε	HOM	Home cursor
05	E	θ	EOL	Erase to end of line
06	F	ι	EOS	Erase to end of screen
07	G	λ		
08	H	μ	BS	cursor left
09	I	ν	HT	cursor right
0A	J	¶	LF	cursor down
0B	K	Σ	VT	cursor up
0C	L	♦	FF	screen clear
0D	M	▼	CR	cursor to left margin
0E	N	■		
0F	O	Ω		
10	P	o	DS	special symbol prefix (down shift)
11	Q	₁	DC1	AUX to logic
12	R	₂		
13	S	₃	DC3	AUX to logic
14	T	₀		
15	U	²		
16	V	±		
17	W	÷		
18	X	≈		
19	Y	√		
1A	Z	∫		
1B	ESC	|	ESC	cursor sequence prefix
1C	\	←		
1D	]	→		
1E	↑	↑		
1F	_	↓		
7F	DEL	▒	DEL	delete previous character

(4) Type and confirm control characters:

control L	should clear screen
. (dot)	should print dot and leave cursor to right of dot
control H	should move cursor under dot
control I	should move cursor to right of dot
control J	should move cursor down one line
control K	should move cursor up one line
control K	cursor should not move, but dot should move down one line
control K	dot should move down one line again
carriage return	cursor should move to left margin
ESC	nothing happens
=	nothing happens
?	nothing happens
?	cursor moves to lower right corner of screen
carriage return	cursor moves to lower left corner of screen
ESC	nothing happens
=	nothing happens
control @	nothing happens
?	cursor moves to upper right corner of screen
control D	cursor moves to upper left corner of screen
"dot, followed by control J" 15 times	creates a diagonal of dots
control K 8 times	moves cursor up
dot 4 times	prints 4 dots
control H 12 times	positions cursor under dot in diagonal
control E	erases right hand portion of line, including cursor position
M	prints M
control F	erases screen below line with M
control L	clears all of screen

INTRODUCTION

The VID consists of two independent functional units: Keyboard transmitter and a monitor screen receiver. The only interaction between the two occurs when certain received control characters initiate time consuming operations on the screen (the clear operations). During those operations the keyboard is not scanned. However, there is no keyboard action which directly causes any action on the screen. Any action to be produced on the screen must be received from the serial loop. Therefore, data transmitted away from the VID must be echoed back to the VID by the external equipment if it is deemed desirable to allow keyboard initiated actions. The following sections discuss the operation of the transmitter and receiver as independent units.

RECEIVER OPERATION - ASCII

DATA FORMAT: The receiver operating in ASCII mode recognizes a 7 bit code with parity bit (which is ignored). A minimum of 1.0 stop bits must be received; longer stop bits are interpreted as idle time.

PRINTABLE CHARACTERS: Characters in the bottom 3 rows of the character set may be displayed on the screen simply by transmitting to the VID the corresponding 7 bit code. (Parity bit is ignored). To display one of the special printable characters, a two character sequence must be transmitted. The first character of the sequence is a DS (downshift) (CTRL P, or 10 hex). The second character is the seven bit code for the displayed character. In effect, the DS character enables the special character decoding function for the character after the DS. Upon reception of the displayable character or character sequence, that character is written to the screen at the current cursor position. Then, unless the cursor is already in the rightmost column, the cursor moves to the right one column. Attempting to move the cursor past the right margin causes the rightmost column or the beginning of the line, when the VID is configured for 32 characters per line, to be overwritten with the most recently received character.

SPECIAL CHARACTERS

CURSOR MOVES: The basic cursor moves available are:

(1) HOME -- moves cursor to upper left hand corner of screen. Data is not changed.
(2) BACKSPACE -- moves cursor left one column unless already in left most column. Moving cursor beyond left margin is inhibited. Data is not changed.
(3) HORIZONTAL TAB -- moves cursor right one column unless already in rightmost column. Data is not changed.
(4) LINE FEED -- moves cursor down one line of data. If cursor was already on bottom line of screen, all data on screen is shifted up one line, the previous top line of data is lost, and the new bottom line is cleared. If cursor was not already on bottom line, only the cursor moves, and no data is changed.
(5) VERTICAL TAB -- moves cursor up one line of data. If cursor was already on top line of screen, all data on screen is shifted down one line previous bottom line of data is lost, and new top line is cleared. If cursor was not already on top line, only cursor moves, and no data is changed.
(6) CARRIAGE RETURN -- moves cursor to left most column of current line. No data is changed.

VAB-2 Control Characters.

OCTAL	HEX	CTRL	FUNCTION	
004	04	D	HOM	Home - moves cursor to upper left corner of screen
005	05	E	EOL	Erase end of line - erases current line from right margin to current cursor positon (1600 ms max)
006	06	F	EOS	Erase end of screen - erases lines from bottom of screen to, but not including, current line (400 ms max)
010	08	H	BS	Back space - moves cursor left one column unless already in left most column
011	09	I	HT	Horizontal tab - moves cursor right one column unless already in right most column
012	0A	J	LF	Line feed - moves cursor down one line, scrolls screen up if already on bottom line
013	0B	K	VT	Vertical tab - moves cursor up one line, scrolls screen down if already on top line
014	0C	L	FF	Form feed - clears screen and homes cursor (400 ms)
015	0D	M	CR	Carriage return - moves cursor to left margin
020	10	P	DS	Down shift sequence - causes character following DS to be interpreted as printable rather than control. Required for lower 32 symbols (Greek and math), but may be used with any characters.
021	11	Q	DC1	Device control - sets AUX bit to logic 1
023	13	S	DC3	Device control - sets AUX bit to logic 0
033	1B		ESC	Start cursor sequence - ESC ± V H adds V modulo 16 to vertical cursor address H modulo 64 to horizontal cursor address ESC = V H sets vertical sursor address to V modulo 16 horizontal cursor address to H modulo 64
177	7F		DEL	Delete - moves cursor left one column, unless cursor was already on left most column; erases new position

CURSOR SEQUENCE: Two special cursor sequences are provided for absolute and relative x-y cursor addressing. Each sequence consists of four characters:

(1) ESC (033 octal, or 1B hex)

(2) + for relative (053 octal, or 2B hex)
= for absolute (075 octal, or 3D hex)

(3) vertical address or displacement

(4) horizontal address or displacement

For relative addressing, the displacement is add-d to the current cursor valve, and the result is truncated to 4 bits (vertical) or 6 bits (horizontal). As a result, "wrap around" cursor positioning is possible.

CURSOR EXAMPLES

Cursor is at V=0, H=0 (upper left corner). This sequence is received: "ESC" "+" "A" "C". "A"=41 (hex) which is added to the current V cursor 0 giving 41 (hex). The result is then truncated (modulo 16 decimal) with a result of 1. Similarly, "C" equals 43 (hex), added to H cursor 0 giving 43 (hex). After truncation (modulo 64) the result is 3. Thus the sequence moved the cursor from 0,0 to 1,3.

Cursor is at V=4, H=5. This sequence is received: "ESC "+" "?" "?". "?" equals 3F (hex). 3F plus 4 equals 43, which after truncation (mod 16) leaves 3. 3F plus 5 equals 44, which after truncation (mod 64) leaves 4. Thus the sequence moved the cursor from 4,5 to 3,4.

The intent of the modulo arithmetic is to allow the programmer to specify the address or displacement either directly in binary (convenient for assembly language) or as literal, printable characters (convenient for high level programming).

ERASES: Several erase functions are provided. It should be noted that some of the erase function require more than one character transmission time to complete. After transmission of an erase, one of the following should occur: transmit filler (NULL's) to the VID as required to delay the proper amount of time, cease transmission for the required amount of time, or expect to lose some number of characters immediately after the erase. In addition, the keyboard is not scanned during erases.

(1) FORM FEED (FF) -- FF clears the entire screen and leaves the cursor in the upper left corner (home position). 400 mS is required. (12 characters at 300 Baud, 4 characters at 110 Baud).
(2) ERASE TO END OF SCREEN (EOS) -- EOS erases complete lines, beginning with the bottom line, and continuing up to but not including the line containing the current position of the cursor. If the cursor is already on the bottom line, no erase occurs. 400 mS maximum required (12 characters at 300 Baud, 4 at 110) for full screen; proportionally less for fewer lines.
(3) ERASE TO END OF LINE (EOL) -- EOL erases characters on current line, beginning at right margin and moving left up to and including original cursor position. 1600 mS maximum required (48 characters at 300 Baud, 16 at 110) for full line; proportionally less for fewer spaces.

(4) DELETE -- Delete moves the cursor to the left one position (but not past left margin) then erases the character at the new position. Delete is functionally equivalent to BACKSPACE SPACE BACKSPACE.

DEVICE CONTROL: A special output signal, designated AUX, is available at U1 pin 29 for custom applications. The AUX pin is set to logic 1 at power up and upon receipt of a DC3 character (023 octal, or 13 hex). The AUX pin is set to logic 0 upon receipt of a DC1 character (021 octal, or 11 hex). The state change will occur within 1 mS after receipt of the device control character. Possible applications for the AUX pin include:

(1) peripheral control
    a. cassette motor stop start
    b. printer enable/disable

RECEIVER OPERATION - BAUDOT

THE BAUDOT CODE: The Baudot code was invented for use with early mechanical teleprinter systems. A 5 bit code is used, giving 32 possible binary combinations. Since the alphabet and number system requires 36 characters, and punctuation was also to be included, a provision was made to give most of the 32 binary values more than one meaning, depending upon retention of previously transmitted information. The Baudot teleprinter has a type basket similar to common typewriters. The type basket has two mechanical positions, one causing letters to be printed, the other causing figures and punctuation. Two binary codes were selected as shift characters: "Letters" (abbreviated LETS) causes the basket to lock into letters position; "Figures" (FIGS) causes the basket to lock into figures and punctuation. The Baudot character and the relationship between LETS and FIGS cases. The VID retains a "case history", enabling the proper display of letters, figures and punctuation.

DATA FORMAT: The receiver operating in Baudot mode utilizes a 5 bit code with no parity bits. A minimum of 1.0 stop bits must be received; longer stop bits are interpreted as idle time.

PRINTABLE CHARACTERS: The Baudot character set (in alphabetical order for ease in locating corresponding letter - figure combinations).

BAUDOT CHARACTER SET

LETS	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
FIGS	-	?	:	*	3	$	&	#	8		(	)	.	,	9	0	1	4	!	5	7	;	2	/	6	"

CONTROL CHARACTERS: Only 5 control characters are used in Baudot mode.

(1) CARRIAGE RETURN - moves cursor to left margin and shifts to "letters" case.
(2) LINE FEED - moves cursor down one line and shifts to "letters" case.
(3) SPACE - "prints" a blank and moves cursor to the right, then shifts to "letters" case.
(4) LETS - causes no action on screen, shifts to "letters" case.
(5) FIGS - causes no action on screen, shifts to "figures" case.

FINAL ASSEMBLY

The keyboard may be mounted on top of the VID board provided adequate space and insulating material is used. If you are using the Netronics keyboard cabinet, mount the ASCII keyboard as per the instructions included with the cabinet. Construct an insulating barrier using heavy oak tag, file folder, etc., make it the exact size of the ASCII keyboard providing holes for the 4 board mounting studs and 2 support screws. Secure the insulating barrier with (4) 8-32 nuts. After the ASCII keyboard and insulating barrier is secured, mount the VID board (component side toward the bottom of the case) into the cabinet and secure with the remaining (4) 8-32 nuts. Note that there should be 2 nuts on the studs between the ASCII keyboard and the video display board. Dress the interconnecting leads out the back side of the cabinet and install the bottom cover.

CONNECTING THE TERMINAL TO YOUR COMPUTER

RS232-C OPTION: Referring to the VID Schematic Diagram note J1 pin 2 is the RS232 input, j1 pin 3 is the RS232 output, and that pin 1 is ground. To connect the VID to a Netronics Explorer 85 simply make the following connections:

VID J1 Pin 1 to Explorer J1 Pin 1
VID J1 Pin 2 to Explorer J1 Pin 3
VID J1 Pin 3 to Explorer J1 Pin 2

NOTE: -8V DC supply will be required on your Explorer.

To connect the terminal to an ELF II Giant Board make the following connections:

VID J1 Pin 1 to Giant Board A14 Pin 5
VID J1 Pin 2 to Giant Board A14 Pin 12
VID J1 Pin 3 to Giant Board A14 Pin 2

NOTE: Install jumpers J4, J6 and J12 on your Giant Board. A switch at J11-12 is not necessary because the software has been rewritten allowing both the terminal and keyboard to communicate with the EF-4 line.

-8V DC supply will be required on your Giant Board.

BAUDOT/HEX Conversion

HEX CODE	LETTERS	CONTROL	FIGURES
00			
01	E		3
02		LINE FEED	
03	A		-
04		SPACE	
05	S		1
06	I		8
07	U		7
08		CARRIAGE RETURN	
09	D		*
0A	R		4
0B	J		BELL
0C	N		,
0D	F		$
0E	C		:
0F	K		(
10	T		5
11	Z		"
12	L		)
13	W		2
14	H		#
15	Y		6
16	P		0
17	Q		1
18	O		9
19	B		?
1A	G		&
1B		FIGURES	
1C	M		.
1D	X		/
1E	V		;
1F		LETTERS	

ASCII/HEX Conversion

HEX CODE	CHAR	HEX CODE	CHAR	HEX CODE	CHAR	HEX CODE	CHAR
00	NUL	20	SP	40	@	60	`
01	SOH	21	!	41	A	61	a
02	STX	22	"	42	B	62	b
03	ETX	23	#	43	C	63	c
04	EOT	24	$	44	D	64	d
05	ENQ	25	%	45	E	65	e
06	ACK	26	&	46	F	66	f
07	BEL	27	'	47	G	67	g
08	BS	28	(	48	H	68	h
09	HT	29	)	49	I	69	i
0A	LF	2A	*	4A	J	6A	j
0B	VT	2B	+	4B	K	6B	k
0C	FF	2C	,	4C	L	6C	l
0D	CR	2D	-	4D	M	6D	m
0E	SO	2E	.	4E	N	6E	n
0F	S1	2F	/	4F	O	6F	o
10	DLE	30	0	50	P	70	p
11	DC1	31	1	51	Q	71	q
12	DC2	32	2	52	R	72	r
13	DC3	33	3	53	S	73	s
14	DC4	34	4	54	T	74	t
15	NAK	35	5	55	U	75	u
16	SYN	36	6	56	V	76	v
17	ETB	37	7	57	W	77	w
18	CAN	38	8	58	X	78	x
19	EM	39	9	59	Y	79	y
1A	SUB	3A	:	5A	Z	7A	z
1B	ESC	3B	;	5B	[	7B	{
1C	FS	3C	§	5C	\	7C	|
1D	GS	3D	=	5D	]	7D	}
1E	RS	3E		5E	^	7E	~
1F	VS	3F	?	5F	§	7F	DEL

WARRANTY: All components of this kit are warranteed for six months from the date of shipment. Defective components will be replaced free of charge if returned within six months with $1.00 each to cover testing and return postage. Return parts in a suitable package and ship insured to Netronics Research & Development Limited, Route 202, New Milford, Connecticut 06776, attention: Service Department, with a letter explaining the defect. Any parts received damaged due to poor packaging will be returned. (i.e., DO NOT ship IC's in envelopes via the mail).

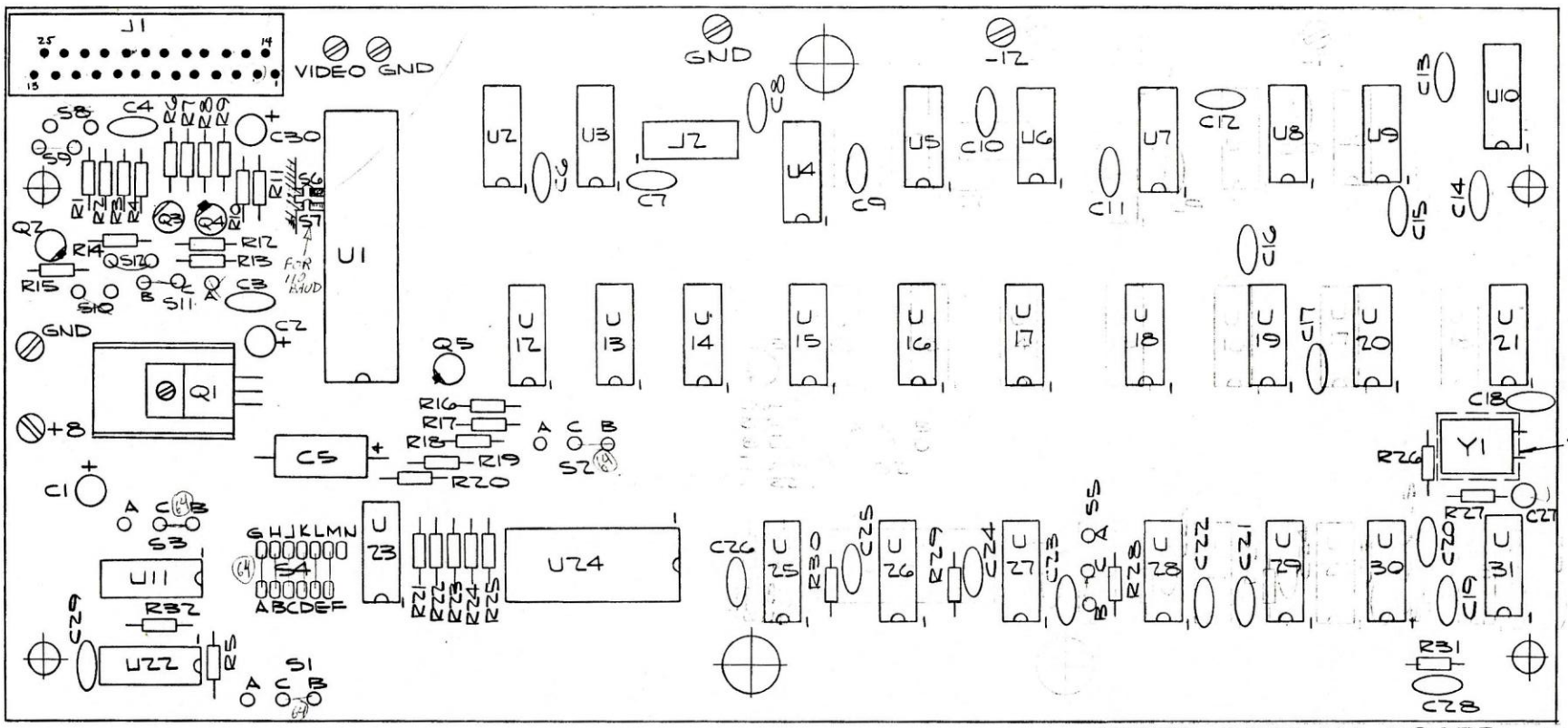
IN CASE OF DIFFICULTY: After having carefully checked your work and you still have difficulty getting your Explorer to work, the Factory Service Department will repair, fully test, and return your system for a flat fee (see below). This covers all parts, except parts destroyed by your negligence, (i.e., IC installed backwards, broken, etc.), and return postage. Package the unit (less cabinet) carefully and return insured with a letter describing the difficulty.

If your system includes other level components, please see the instruction book for fees which apply to the further expanded systems. If any components are added which are not part of a Netronics kit you will be advised of the service charge prior to any work being done. If you have added any "Levels" to your system (using your own parts) it would be advisable to purchase the appropriate assembly manual, which will contain any factory modifications or updates, prior to returning your unit.

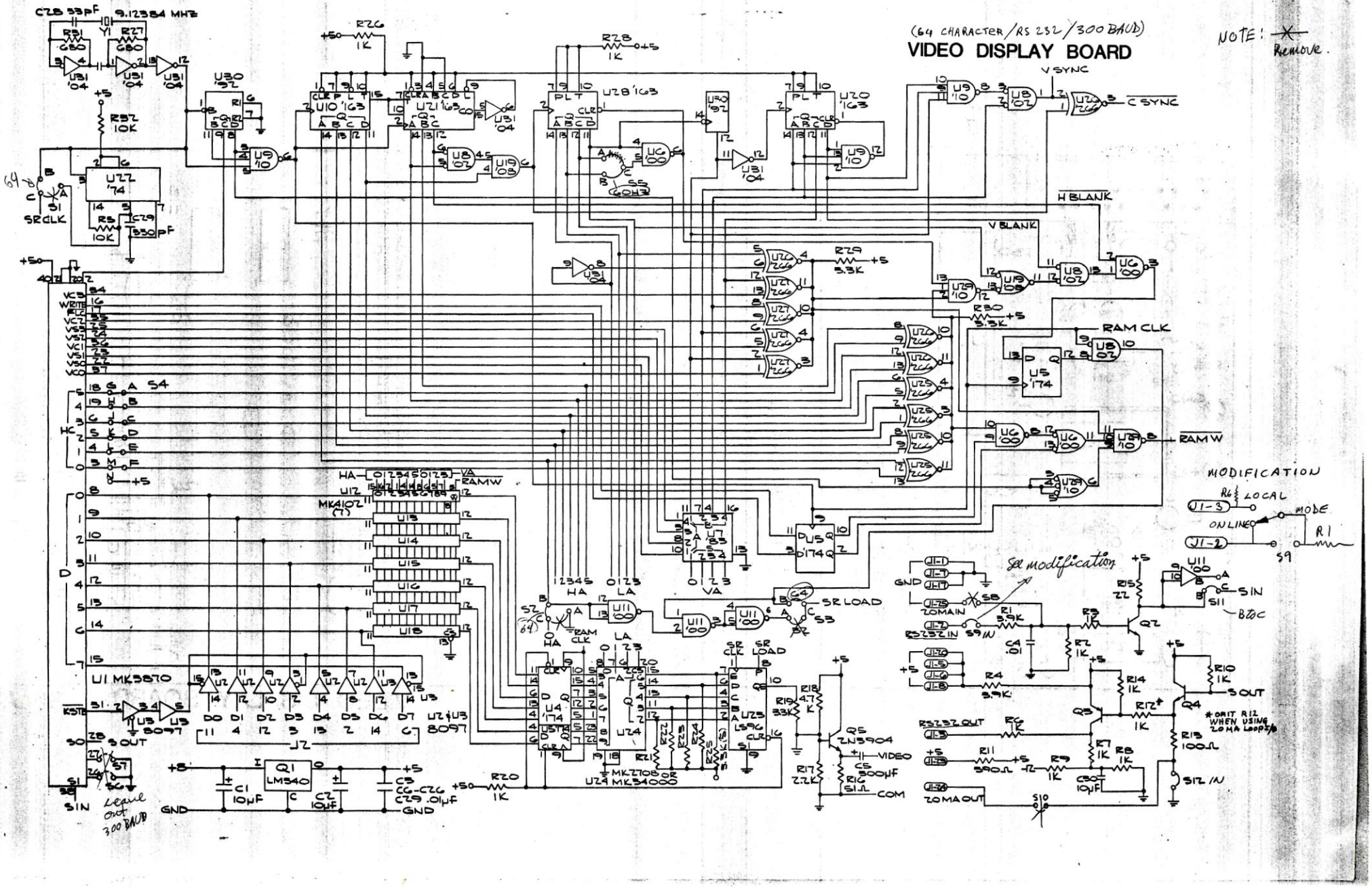
SCHEDULE OF IN WARRANTY FACTORY TROUBLESHOOTING PRICES*

	FLAT FEE
Level A	$12.50
Hex Keypad/Display	7.00
Level A + B	16.50
Level A + B + D and/or E	20.00
Power Supply	6.50
ASCII Keyboard	7.00
Video Display Board	9.50

* Covers cost of all parts except those destroyed by the customer. These prices are not valid for levels added using parts not obtained from Netronics. If you have parts not supplied by Netronics send your unit and request a quotation.



VIDEO DISPLAY BOARD


(64 CHARACTER/RS 232/300 BAUD)
VIDEO DISPLAY BOARD
NOTE: X Remove.
C28 33pF
9.12384 MHz
Y1
R26 1K
R28 1K
R27 680
R31 680
R32 10K
U27 '74
R5 10K
C29 330pF
U30 '32
U10 '163
U28 '163
U20 '163
V SYNC
C SYNC
H BLANK
V BLANK
R29 5.3K
R30 5.3K
RAM CLK
U5 '174
RAM W
MODIFICATION
R6 LOCAL
J1-3
MODE
ON LINE
J1-2
R1
59
See modification
U1 MK3870
U2 U3 8097
U4 '174
U23 LS96
U24 MK34000
MK2708 OR
R18 4.7K
R19 33K
R17 2.2K
Q5 2N3904
C5 500µF
R16 51Ω
VIDEO
COM
R20 1K
Q1 LM340
C1 10µF
C2 10µF
C3 CC-C26
C29 .01µF
GND
+5
+50
R15 22
Q2
C4 .01
R3 1K
R2 1K
R4 3.9K
R14 1K
R12 1K
Q3
Q4
R10 1K
R13 100Ω
R7 1K
R8 1K
C30 10µF
R11 390Ω
R9 1K
20MA OUT
RS232 IN
RS232 OUT
SIN
SOUT
SR LOAD
SR CLK
RAM CLK
* OMIT R12 WHEN USING 20 MA LOOP
Leave out 300 BAUD

TINY BASIC MODIFICATIONS

In order to use Tiny Basic with the Netronics VID Board and the Elf II, the following patches and modifications will be necessary. These changes will free up 1K of memory for user program use.

Before making the changes, connect your pretested terminal (ASC II Keyboard and VID board) to your Giant Board. Note that the switch suggested in the Giant Board instruction book is not necessary. Simply install jumpers J4, J6 & J12, plus connect the -8V supply (the -8V input could be grounded if the lead length between the terminal and your Elf II is less than 3 feet).

To make the changes to your Tiny Basic tape, load your tape into RAM at ØØØØ to ØFFF. Then make the changes listed below:

Change the first 16 locations as follows:

ØØØØ CØ FØ ØØ CØ FØ ØØ DØ ØØ
ØØØ8 ØØ ØØ ØØ ØØ AØ 9A BØ DØ
Now switch to the run mode and enter the following using the Elf II Monitor:
Ø2 ØØ BD 3F (T)
Note: Toggle the run switch each time a change is followed by (T)
Ø2 ØØ C1 37 (T)
Ø2 ØØ DØ 3F (T)
Ø2 ØØ D3 37 (T)
Ø2 ØØ D9 37 (T)
Ø2 ØØ F2 3F (T)
Ø2 ØØ E2 D4 ØØ F6 CØ ØA FE (T)
Ø2 ØA 5D 3F (T)
Ø2 ØA 63 3F (T)
Ø2 ØA 6A 3F (T)
Ø2 ØA 77 37 (T)
Ø2 Ø1 1C ØB 87 (T)
Ø2 ØA 5C 59 (T)
Ø2 ØA 8A 59 (T)
Ø2 ØA 81 3Ø A6 (T)
Ø2 ØA A3 CØ ØA DD (T)
Ø2 Ø1 ØF Ø8 (T)
Ø2 ØA A6 8F CE FB FF 32 DB D7 13 8F F3 32 CF 2D 8F F3 3A BF D7 11 ØD FF Ø1 5D 3Ø DB 8F
D4 ØB 69 D4 ØB 5B 3B CB FF 43 C8 FF 23 3B DB E2 8F 73 D4 ØØ F6 D4 Ø3 D5 12 Ø2 38 8F D5
8C CE FB FF 32 FC 8C D4 ØB 73 D4 ØB 5B 3B EF FF 42 C8 FF 22 3B FC 8C E2 73 D4 Ø3 D5 12
Ø2 38 8C D5 D7 1Ø F8 4Ø 5D D4 ØØ F6 D4 Ø3 CC F8 ØB B9 F8 21 A9 D4 Ø3 C5 D4 ØA 5A FB 4E
3A 1E D7 1Ø F8 8Ø 5D CØ Ø2 Ø4 ØD ØC 4E 45 54 52 4F 4E 49 43 53 2Ø 54 49 4E 59 2Ø 42 41
53 49 43 ØD ØA 43 4F 5Ø 59 52 49 47 48 54 2Ø 31 39 37 39 ØA ØD ØA 3F 57 49 44 54 48 3D
2Ø 33 32 2Ø 28 59 2F 4E 29 8Ø D7 12 FC Ø1 2D 5D D7 11 FA CØ FE D7 12 D5 FB ØD 3A 72 D7
11 F8 ØØ 5D D5 8C 73 FB ØC 3A 83 F8 8Ø AC D4 ØØ F6 2C 8C 3A 7C 12 Ø2 3Ø 69 (T)
Ø2 ØØ 12 ØØ (T)
Ø2 ØØ ØØ CØ Ø1 ØØ (T)

This completes the changes. The Tiny Basic program should now be running.

Depress the carriage return on your terminal. The screen should clear followed by:

```
NETRONICS TINY BASIC
COPYRIGHT 1979

? WIDTH = 32(Y/N)
```

If your terminal is confirgured for 32 characters per line, type "Y". If 64 characters per line, type "N". Basic will respond with a prompt:

```
To make a new tape enter the following command:
IF USR (12, 3) C/Return
```

This will return control to the Elf II Hex Key Pad and monitor. Now enter via the Hex Key Pad: Ø3 ØØ ØØ ØB FF
Place your recorder in record mode and depress input. (make sure to use a new tape). The video screen will be displaying a random pattern during the record cycle. The screen will be cleared when restarting the Basic program.

To use your new modified Tiny Basic, simply reset-- then run your Elf II. The key used to delete line characters has been changed from the "DEL" key to "CTRL H" key. This key is formed by depressing the "H" key while holding down the "CTRL" key. The Plot command is no longer operational because it communicated with the 1861 Video chip which is no longer in use. A new Plot function can be programmed using the special characters and absolute and relative addressing features on your VID. All other aspects of Tiny Basic is the same as described in your user manual.

Special Note:

If your TV is"over-scanning"the 32 characters per line, the line length can be reduced to 30 C/L with the following changes:

LOCATION		DATA
ØACC	to	21
ØAFØ	to	20
ØB53	to	30

A factory programmed Tiny Basic (Terminal Version) tape only is available at $9.95 and .50 P & H.